VAA-Weekly-Progress

01/28-02/04

Context

- Discussions regarding our research questions

  - Species Similarity

    - Decided to go with three plans: Limb Ratios, Centroid Variance, Dino feature

      clustering

  - Keypoint evaluation

    - Decided to create multiple keypoint definitions to then evaluate using OKS on

      labeled images

Goals

- Limb-ratio - Medha, Zian
  - Normalized with the bounding box (skeletal limbs ratio to bounding box height)
  - Csv save
- Centroid variation - Parth
  - Centroid experimentation (center of body keypoints excluding the head, leg keypoints)
  - Normalized with the bounding box
- Dino feature extraction - Josh
- Prior works in species similarity - Shaan
- Create biologically accurate keypoint definitions - Medha, Claire
- Continue labeling antelopes using the original definition

Limb Ratios

- Created a script which uses images from Parth's side-view

  collection as input

- Finds the associated annotation file, extracts the

  annotations

- Uses the skeleton as defined by COCO for finding the limbs

- Then divides limb length by bounding box height to

  regularize for distance away from the camera
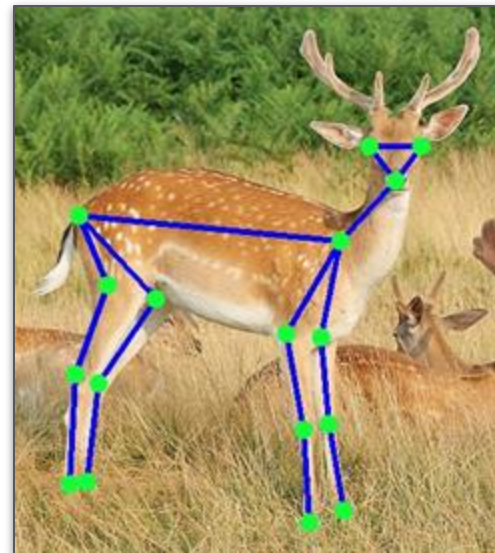
Centroid Variation (Breakdown)

- Created a script to measure distances from centroid as an array for each image
  - Uses these distances to create a csv (for each species) row entry for each image with each col for 1 keypoint, and it's variation from the centroid in each cell;
- Done via (distance / avg distance from centroid); slight modification from the coefficient of variation (cv); this gives us a relative measure of distance from the centroid
  - 1.0 means the keypoint is at the average distance from the centroid
  - > 1.0 indicates the keypoint is further from the centroid than average
  - < 1.0 indicates the keypoint is closer to the centroid than average
- Averaging of variation across all images for the respective species, condensing the data into one vector with an average variation for each keypoint to perform cosine similarity across all species vectors

Centroid Variation (Results)

```
Top 10 Species Most Similar to Antelope:
argali sheep       0.998723
horse              0.997937
deer               0.994156
zebra              0.992842
moose              0.992537
giraffe            0.991767
king cheetah       0.989388
sheep              0.987457
bison              0.987215
fox                0.986510
```

```
Bottom 10 Species Most Similar to Antelope:
raccoon            0.954433
spider monkey      0.948246
monkey             0.947901
beaver             0.947896
panda              0.947079
alouatta           0.941170
chimpanzee         0.940325
gorilla            0.931223
noisy night monkey 0.928005
uakari             0.924182
```

Biological Key Points

- Difficult to find an anatomical definition of keypoints

- Working off image found from the Internet

- Worked on eight major key points that have been modified or added (neck, root of tail, shoulder, elbow, wrist, hip, knee, ankle)

Next Steps

- Collect more side view images

- Continue work on centroid variance

- Continue work on feature extraction

- Experiment with combining the three similarity measures

- Continue work with defining keypoints and figure out how to conduct

  procedure of comparing definitions

Personal Progress

Medha

- Worked on limb ratios script
    - Specifically, extracting the annotations for each image within the side-view file
    - Set up the csv saving process and allowing the script to run on all the species and generate the files
- Worked on biological keypoint definitions
    - Tried to find documentation on antelopes, but it is difficult to find
    - Worked off an image of the skeletal labeling of an antelope
    - Worked on the neck and root of tail keypoints

Josh

- Read the DINO paper to get background on how it operates as a feature extractor, and its possible benefits and limitations
- Looked into possible methods to identify the orientation of animals(side view, front view, back view) using either 3D bounding boxes or other methods(more scripts like we currently have for side view)
- Began testing DINO on Google Colab(to prototype implementation)

Next Steps:

- Implement DINO on Deadcat and run it through the AP-10k dataset

Zian

- Worked on limb ratios script
  - Calculate the length of each skeleton after standardization
  - Write length data to a specific cvs file
- Familiar with COCO labeled data and proficient in its application.

Parth

- Worked on Centroid Variation similarity measure
- Developed a script to parse distances from the centroid of the animal, eventually attaining individual vectors of avg variation for each keypoint for each animal
    - Run cosine similarity across vectors, to find similar species morphologically
- Worked on 3 iterations; most promising results come from the approach above

Claire

- Worked on biological keypoint definitions
  - Found documentation on the anatomy of ungulates
    - Used image of skeletal system of horse as reference for the definitions
  - Revised front and back limb keypoint definitions